D

The Quality of Primary Mathematics Teacher Preparation in SA

Findings from PrimTEd

- Nicky Roberts (Kelello Consulting) & Qetelo Moloi (UJ)
10 Nov 2022

RESEP
Research on Socio-Economic Policy

1. Overview

This report provides an overview of key findings from the Primary Teacher Education Development (PrimTEd) project for the period 2018-2021. PrimTEd is a voluntary collective of 25 universities with the aim of monitoring the performance of students in Initial Teacher Education (ITE) programmes for primary school teachers. Assessments in mathematics and English (first additional language) have been collaboratively developed and administered regularly to use assessment data as a rich source to improve teaching and learning. The findings in this report are drawn from assessments that were administered on Foundation Phase and Intermediate Phase ITE students at first and final (fourth) year in the Bachelor of Education (B.Ed) programmes. Where appropriate and for the purpose of this report the PrimTEd findings are juxtaposed with findings from other initiatives that that focus on various aspects of the quality of ITE in South Africa.

a. Where does Initial Teacher Education (ITE) fit within the teacher lifecycle?

Although teacher education is conventionally understood to be limited to four years of formal preparation in B.Ed programmes, it is reasonable to think of teacher education as including all the years that a teacher-to-be learner spends in the schooling system: 12 years in school and 4 years at university (Taylor, 2019). We know that how learners are socialized at school and the types of teaching they are exposed to during their schooling years are predictive of later teaching styles. In the absence of deliberate measures to equip them otherwise, teachers teach the way they were taught. It is, therefore, difficult to undo in 4 years in a B.Ed programme what learners have 'learnt' about teaching in the first 12 years at school. The cycle and phases of a teaching profession are visualized in Figure 1.

Figure 1: The teacher life cycle

Source: Taylor, N (2019); PrimTEd mathematics results, 2017-2019

Internationally there is also increasing attention on the first few years of teaching at a school, where additional mentoring and induction is expected. Teachers in this phase are referred to as having newly qualified teacher status. In some countries, it is only after the first year or two of teaching (with a reduced workload and school-based mentoring) and after passing a standardized test (in English and mathematics) that a newly qualified teacher qualifies with a license to teach. In South Africa this would mean being granted South African Council of Educators – SACE- membership.

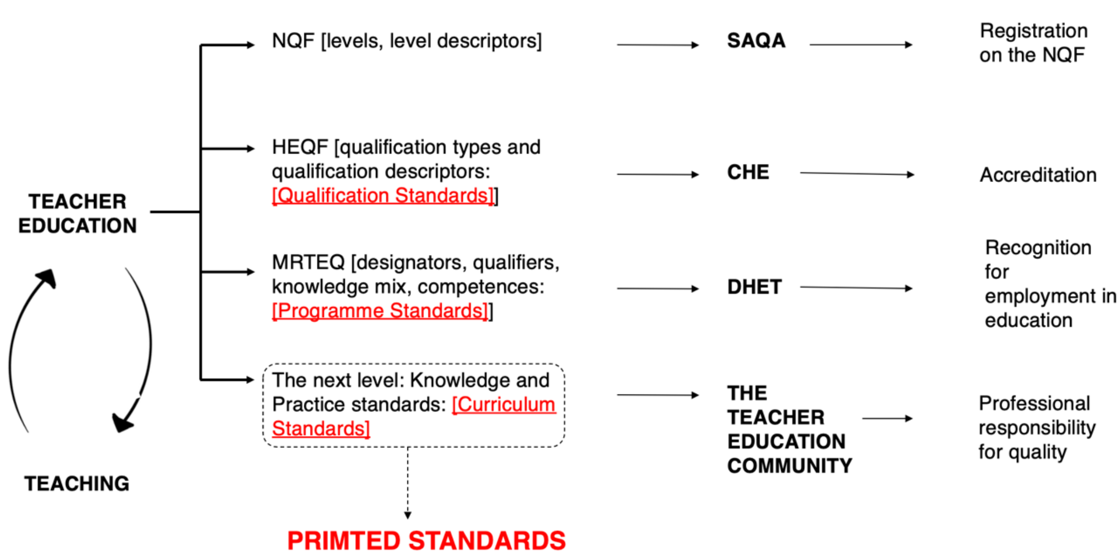
Looking at this life cycle from engaging with the school curriculum (point 1) to career progression and promotion (point 11), it is clear that considerable investment is placed in teacher/ school performance (point 9) and continuing professional development (point 10). Far less attention is directed to the initial teacher education phase (points 3 to 6). Yet this seems to be a major lever for change and improvement in teacher quality. This could have a major impact on the efficacy of school improvement interventions, if the quality of teachers entering schools improved..

b. What is PrimTEd?

PrimTEd is a voluntary collective of 25 universities with the aim of monitoring the performance of students in Initial Teacher Education (ITE) programmes for primary school teachers. Assessments in mathematics and English (first additional language) have been collaboratively developed and administered regularly to use assessment data as a rich source to improve teaching and learning.

In 2000 the *Norms and Standards for Educators (NSE)* was the first formal policy in terms of academic qualifications for educators. Subsequently the *Minimum Requirements for Teacher Education Qualifications (MRTEQ)* policy framework was promulgated in 2014. This outlines language requirements and broad knowledge mix expectations for initial teacher education programmes. The MRTEQ (2014) outlines five types of learning associated with the acquisition, integration and application of knowledge for teaching purposes in initial teacher education: (1) disciplinary learning; (2) pedagogical learning; (3) practical learning; (4) fundamental learning; (5) situational learning (Government of South Africa, 2014, 12). Mathematics subject matter knowledge is an example of disciplinary learning. However mathematics knowledge for primary teaching spans both disciplinary learning and pedagogical learning. Within the broad parameters of MRTEQ, prior to PrimTEd there are no knowledge and practice standards at the level of the curriculum. Taylor and Mawoyo (2022) present the following as a nested approach to standards in teacher education:

Figure 2: A nested approach to standards in teacher education



Source: Taylor and Mawoyo (2022) drawing on Green (2019)

Within the provisions of the *Minimum Requirements for Teacher Education Quality (MRTEQ)* is a requirement to establish and monitor standards for both ITE and Continuing Professional Teacher Development (CPTD). The standards advocated in MRTEQ span the various phases and demands for qualification, accreditation and continuous professional development of a teacher. An overview of the sets of standards that teachers as professionals need to meet are summarised in Figure 2. The statutory bodies and the roles that they play in setting standards firstly for the registration of teachers on the NQF framework, a role played by SAQA, standards for accreditation of teachers which is a jurisdiction of the Council for Higher Education (CHE) and programme standards which are a responsibility of the Department of Higher Education and Training (DHET), are also evident in Figure 2.

The Higher Education Quality evaluation (CHE, 2010) identified low student performance in language and mathematics as a matter of concern and this led to acknowledgement of a serious gap in standards for teaching as a profession, viz that teaching, unlike other professions, lacks internal standards that are initiated and maintained by the professionals themselves. In 2016 PrimTEd was established by the Department of Higher Education, in collaboration with the European Union, to develop knowledge and practice standards for mathematics, languages and literacies. These curriculum standards were collaborative developed over a period of 4 years by ITE lecturers responsible for teaching mathematics, languages and literacies across all 25 universities.

The PrimTEd standards are arranged in relation to two broad mathematics topics: Number and algebra; and Geometry and measurement. These content topics are supported by a further two cross cutting standards: General pedagogic standards; and Mathematical acting the thinking.

Table 1: The PrimTEd mathematics knowledge and practice standards

General pedagogic standards for mathematics teaching	**Mathematical acting and thinking**
GPM 1: Plan effective learning experiences GPM 2: Take learner's knowledge into account GPM 3: Engage learner's productively with mathematics GPM 4: Teach a balanced mathematics curriculum	MAT 1: Playful engagement to search for and develop mathematical insight MAT 2: Represent and use mathematics MAT 3: Reason mathematically MAT 4: Reflect for action
Number and algebra	**Geometry and measurement**
NA 1 Knowledge and use of the emergent number awareness of learners NA 2: Knowledge of numbers systems NA 3: Additive relations	GM 1: Knowledge of Geometrical Properties GM 2: Knowledge of Measurement GM 3: Knowledge of Transformations
NA 4: Multiplicative relations	**Statistics and Probability**
NA 5: Rational numbers NA 6: Integers NA 7: Overarching mathematical ideas for school arithmetic NA 8: Early algebra	SP 1: Statistics and data handling SP 2: Probability

Source: PrimTEd (2020)

From the outset, academics in the participating in PrimTEd were invited to join the PrimTEd assessment workstream, which is tasked with designing assessment instruments for administration at first and fourth year level of the Bachelor of Education programmes.

Following their study of initial teacher education across six universities, Bowie and Reed (2020) noted that "some student teachers are no more proficient in Maths and English than the grade 4 to 6 learners they are preparing to teach." (p.116).

Motivated by concerns about ITE teacher quality, PrimTEd was introduced as a voluntary professional community that undertakes to set and monitor standards for knowledge and practice that characterise the profession. The PrimTEd workstream has produced reports and publications that have revealed important information on what students know and can or cannot do in mathematics knowledge for teaching at primary schools at first year and later when they exit the B.Ed programme after four years.

2. What do we know about the knowledge levels of incoming (first year) and graduating (fourth year) BEd students?

There are a few sources of data on the knowledge and competency of incoming students choosing primary teaching. The main sources prior to PrimTEd were (1) matric marks, and (2) National Benchmarking Tests (NBTs). Bohmer et al (2022) provide an overview of the matric marks of incoming B.Ed students and therefore the focus in this section is on NBTs. This is followed by findings from the PrimTEd mathematics tests.

a. An overview of achievement levels on the National Benchmark Tests (NBTs)

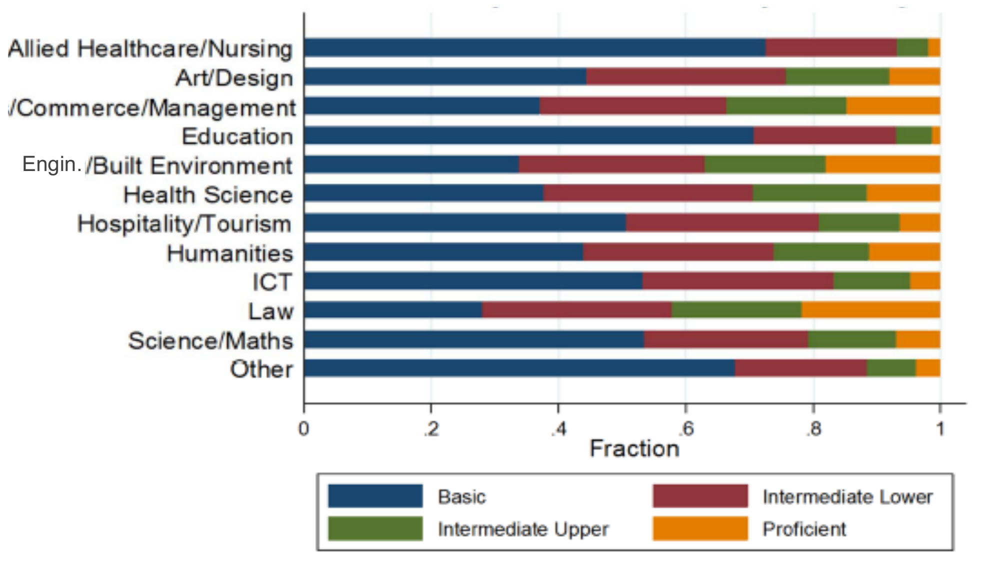
The NBT project was commissioned in 2005 by HESA. In 2018, the project reached maturity as a standalone and self-funding project, hosted at the University of Cape Town. (See https:// nbt.ac.za). Three tests make up the NBTs: (1) Mathematics (2) Academic Literacy and (3) Quantitative literacy. The majority of teachers entering Bachelor of Education programmes for primary teaching do not have mathematics at matric level. They enter university with mathematics literacy. We therefore do not consider the NBT mathematics test, but focus rather on the quantitative literacy results.

The NBT quantitative literacy test assesses student's levels of quantitative literacy expected as a requirement for undergraduate degree study. This includes the ability to read tables and graphs, use decimals, and percentages. It includes solving simple additive relation and proportional reasoning tasks. As such, the NBT quantitative literacy test requires some mathematics, but it not a test of mathematical knowledge for primary school teaching.

The NBT quantitative literacy test offers a useful corroboration to grade 12 mathematics literacy results. In addition, the NBT qualitative literacy test facilitates a comparison between entrants to different faculties at university level. It considers a smaller set of Grade 12 learners (those who have obtained a National Senior certificate at bachelors pass level) and who qualify for entry into university. The sample is further reduced from that of the NSC cohort exiting schools, as not all universities require the NBT as an entrance requirement. The test is written at an individual learner fee of R130. It tends to be historically advantaged universities which make the NBT an entrance requirement.

Poor attainment in mathematics is evident in the results of the National Benchmark Tests (NBT's), written by matriculants seeking to enter universities that require the NBT.

Figure 3: 2018 NBT performance levels for Quantitative Literacy (n=18,000) by intended faculty of study



Source: Prince, R (2019) National Benchmark Test project: Latest NBT data, trends and implications

It is striking that university entrants into Education, and Allied health care/Nursing have the weakest attainment on the NBT quantitative literacy test. About 70% of applicants to Education perform only at the basic level for quantitative literacy. Intermediate upper is expected as a requirement for success at university. The students entering Education faculties (at the universities requiring NBT tests for admission) are very weak in quantitative literacy.

We turn now to focus on achievement levels in the PrimTEd mathematics test, which is specifically designed to assess mathematics knowledge for teaching at the primary school level.

b. What are the PrimTEd tests?

The PrimTEd assessment instrument was developed by ITE colleagues as a reasonable measure of what might be expected of teachers completing a B.Ed programme. It was administered at two points in time – at the beginning and end of the B.Ed programme. As neither starting points, now exist points were know, the same test instrument was used for both years. Each year, first year students are encouraged to write the test in the first semester, while fourth year students are encouraged to write in the second semester.

The initial PrimTEd test comprised a set of 50 mathematics items of a multiple-choice format that assess students' "mathematical knowledge for teaching". The test largely covers mathematics content that teachers are expected to be able to teach in primary school but also includes a smaller proportion of items that assess the pedagogical knowledge of the teachers. The test is administered online under invigilation of at least one lecturer. Students are able to complete the test within 90 minutes (Alex & Roberts, 2019).

The test items are categorized in relation to the mathematics content domains: whole number and operations (24%), rational number and operations (38%), patterns, functions and algebra (16%), geometry (8%) and measurement (14%). The items are also classified as either lower or higher cognitive demand as stipulated by Stein, Grover and Henningsen (1996) framework on tasks. While 'lower cognitive demand' items were considered to be routine procedures; the 'higher cognitive demand' items involved moves between representations; required insight; connected across topic areas; and/or had no obvious procedure or starting point (Venkat, Bowie, & Alex, 2017).

The following provides two illustrative examples of the kind of items included in the PrimTEd mathematics test:

Exemplar item 1: Rational number, low cognitive demand

0,7 is a decimal fraction. Write 0,7 as a common fraction.

Exemplar item 2: Rational number, high cognitive demand

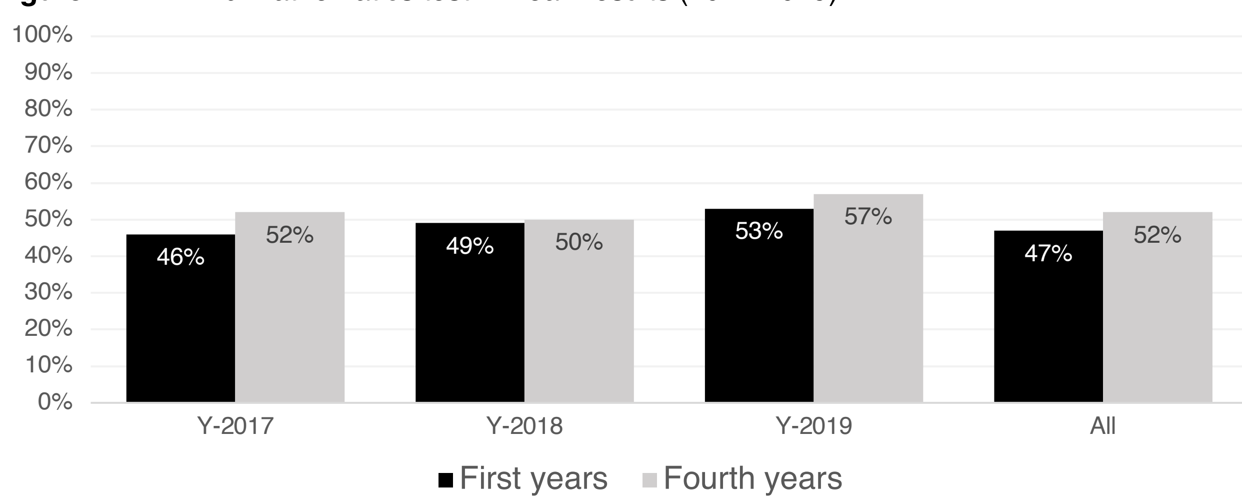
A farmer's cost for milk production is R3,12 for each litre. What are his production costs for 2,5 litres of milk? The calculation you need, to get the correct answer is:
A. 3,12 × 2,5
B. 3,12 - 2,5
C. 2,5 ÷ 3,12
D. 3,12 ÷ 2,5

Ordinarily in assessments of this type the average student is expected to obtain a score of 60% correct responses with scores ranging up to 100%.

c. Achievement on the PrimTEd mathematics tests

There are several ways to report on the PrimTEd assessment data. The first way we report is considering cross sectional data by year. Roberts and Porteus (forthcoming) report on the attainment in the PrimTEd mathematics tests for the period prior to Covid-19. During this time PrimTEd assessments were administered under invigilated conditions in university computer laboratories. Across all institutions which participated across the three-year project period (2017-2019), the mean result of first year students was 47.6% (SD = 15.6%). The mean result for fourth year students was 52.5% (SD = 16.5%). As such, the improvement in mathematical knowledge between first- and fourth-year students was only 5 percentage points.

Figure 4: PrimTEd Mathematics test – mean results (2017-2019)

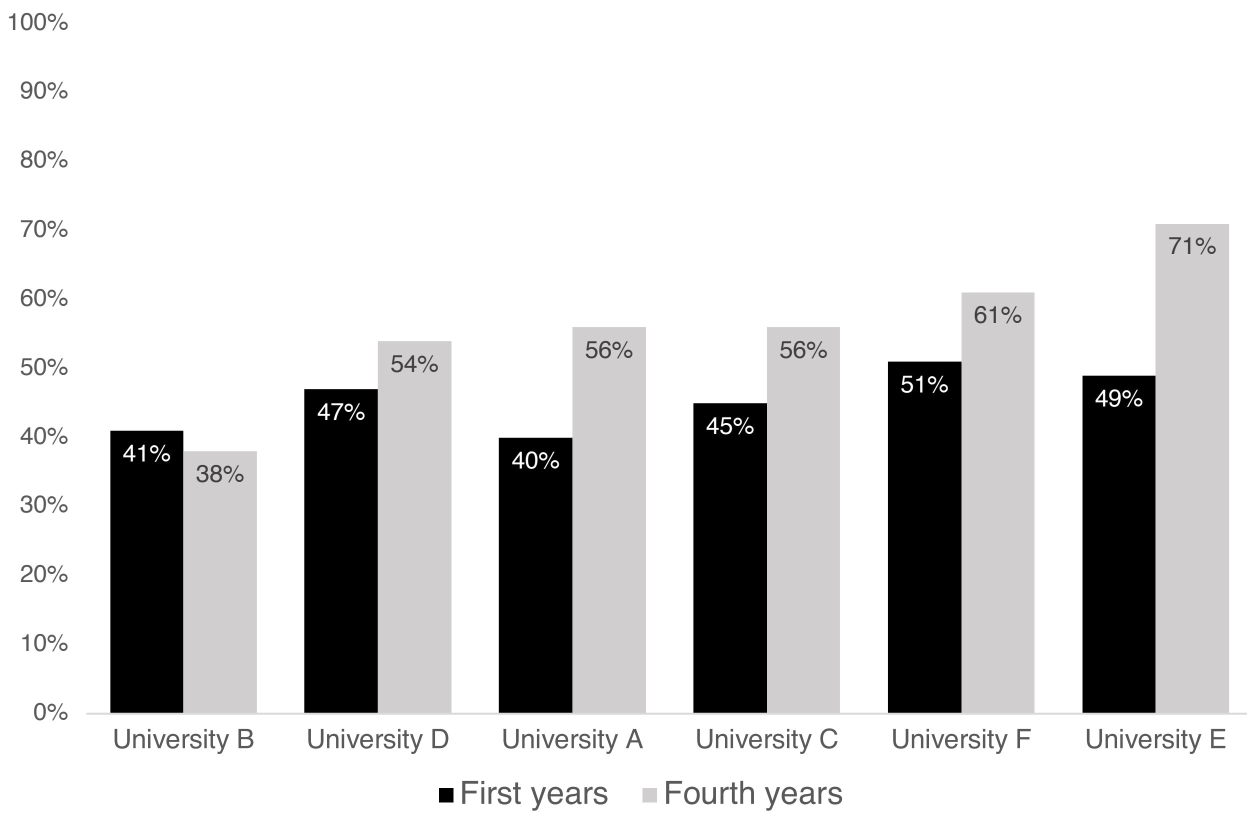


Source: PrimTEd assessment workstream (2019), adapted from Roberts & Porteus (forthcoming)

Strikingly, the results were common to a great extent across institutions of higher education. That is, despite the best efforts of teacher educators, the majority of students are not improving their mathematical knowledge significantly during their years of study. The weak mathematical confidence and skills inherited from their schooling careers appears to persist over the four-year Bachelor of Education experience.

Another way is to focus on a particular year, and reflect on shifts evident in the cross sectional data by university. Here we present the 2019 data which had the widest university participation. We focus only on the six universities which had both sets of data: first year and fourth year.

Figure 5: PrimTEd Mathematics test – mean results by university (2019)



Source: PrimTEd assessment workstream (2019), adapted from Roberts & Porteus (forthcoming)

Here some variation is evident across universities. Universities A and E show fairly large differences in their cross sectional data comparing first years to fourth years. In contrast, University B's fourth year students perform lower than their first year students. This suggests a need to research and share the course design at University A and University E.

There was a disruption to the PrimTEd testing in 2020 due to Covid-19. As a result the PrimTEd test was administered in un-invigilated conditions with students completing the test at a set time and for the same duration, but from their homes. This disruption is explored in Roberts and Maseko (2022). To obtain a broad overview of the PrimTEd data for the period 2018 to 2021, we explored the biggest possible data set at first and fourth year levels, collating all the data into Tables 1A and 1B for first years and fourth years, respectively.

Table 1A: First year student performance (2018-2021)

Institution	2018	2019	2020	2021	Mean
University G	37				37
University B	49	45	46		37
University C		47	40	52	39
University A	39	40			40
University I	33	44			40
University D		41			41
Overall mean	**48**	**47**	**42**	**52**	**43**
University F	46	50			48
University J		51			51
University H	55	49			52
University K		53			53
University E	55	51			53
University L		62			62

Table 1B: Fourth year student performance (2018-2019 & 2021)

Institution	2018	2019	2020	2021	Mean
University A	44	56			33
University D		38		54	37
University B		56		58	39
Overall mean	**49**	**44**		**63**	**47**
University M		52			52
University G				54	54
University E		61			61
University H	64	71			66
University C		54		81	74

Source: Roberts & Moloi, drawing on PrimTEd data, 2022
There was no data for fourth years in 2020 due to Covid-19 university disruptions.

For both groups, the mean (average) score over the specified period was less than the 60% that would ideally be expected in assessments of this type. Also, there is a difference of only four percentage points between the average performance of first years (43%) and fourth years (47%) suggesting that, after four years in the B.Ed. programme, the final year students have made very minimal gains (+4 percentage points) in mathematics knowledge when compared to their first year r counterparts.

Comparisons across the universities show that for the first years, as shown in Table 1A, there is an even split with half of the 12 universities performing below the mean score and the other half above. Only one university performed around the ideal 60% for the first years. For the fourth years five of the eight universities performed above the mean score with three of the five performing at the ideal 60% and above.

d. Levels of achievement: Standards-based reporting

Whilst basic descriptive statistical information such as mean and correct answers obtained by a student in a test provide an important quantitative overview of a student's competence, it is equally important for meaningful interventions to obtain qualitative information on what the student knows, can or cannot do in the content that is being assessed. The PrimTEd Assessment workstream has embarked on a process of developing standards-based PrimTEd assessment reports that can be used to describe what students know and can or cannot do as a demonstration of their mathematics skills (Moloi, Kanjee & Roberts, 2019). The initial process, which is currently under review, of standard setting resulted in defining Performance Levels (PLs) that are used to place students on a hierarchy of mathematics knowledge and skills that range from "Not Achieved" (NA) through "Partially Achieved" (PA), "Achieved" (Ach) to "Advanced" (Adv) with Performance Level Descriptors (PLDs) that describe the depth and breadth of skills that distinguish students at various performance levels. Beyond the quantitative calculations of cut-scores that demarcate performance level, teams of "experts" collaborate to identify specific knowledge and skills or performance level descriptions that distinguish students who function at different performance levels. The process of developing a standards-based report, using performance levels and performance level descriptions is described in Moloi, Kanjee and Roberts (2019). A summary of the PrimTEd mathematics performance levels and performance level descriptions is given in Table 2. Using the performance levels and the descriptions that distinguish each level, the proportion of students who function at different levels in mathematics knowledge and skills is evident.

Table 2: PrimTEd mathematics performance levels and performance level descriptors

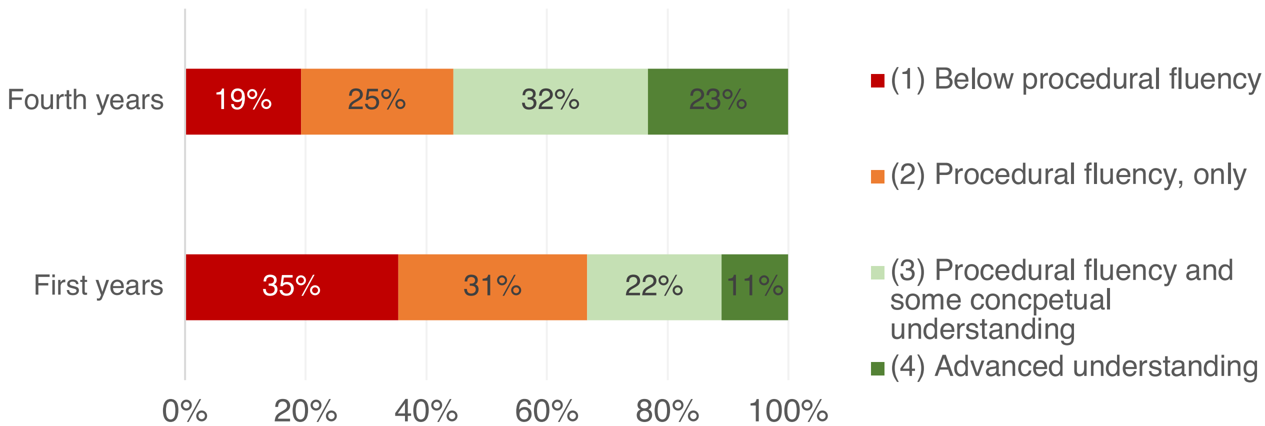
Procedural fluency, only (Standards are partially achieved)	**Procedural fluency, and some conceptual understanding (Standards are achieved)**	**Advanced understanding (Standards are achieved at an advanced level)**
Student functions largely at 'operational' as opposed to 'conceptual' level & can: • *do simple straightforward operations (+, - & x) that involve whole numbers;* • *identify whole numbers on a number line;* • *identify regular geometric shapes;* • *calculate area & perimeter of rectangles using numbers, not symbols;* • *solve problems of one-variable: time/money.*	Student functions largely at 'conceptual' as opposed to 'operational' level & can: • *operate equally well with symbols & numbers;* • *make reasonable estimations of spatial dimensions & have 'good sense' of proportion;* • *express decimals as comm. fractions & vice versa and do estimations that involve both;* • *solve complex problems that involve more than one variable, e.g. money & mass;* • *support their viewpoints with valid reasons.*	Student functions predominantly at 'conceptual' level & use operations to support reasoning & can: • *Organise & arrange both numbers, variables & functions in logical order to solve problems;* • *work efficiently with a wide spectrum of real numbers;* • *'visualise' & operate complex spatial transformations to solve problems;* • *support their viewpoints with valid reasons.*

Source: Moloi, Kanjee & Roberts, 2019

"Not achieved" refers to not meeting the "partially achieved" level, which is considered to be below basic fluency.

The following presents the performance levels for the largest data set, collected across 14 universities, from 2017 to 2020, for first year (*n* = 3 799) and fourth year (*n* = 1 062) students. Figure 6 provides information on the proportions of first year and fourth year students, who function at different levels in mathematics knowledge and skills that they need in order to teach effectively.

Figure 6: Performance level on PrimTEd mathematics test



Source: Roberts and Moloi, 2022, drawing on all available PrimTEd assessment data

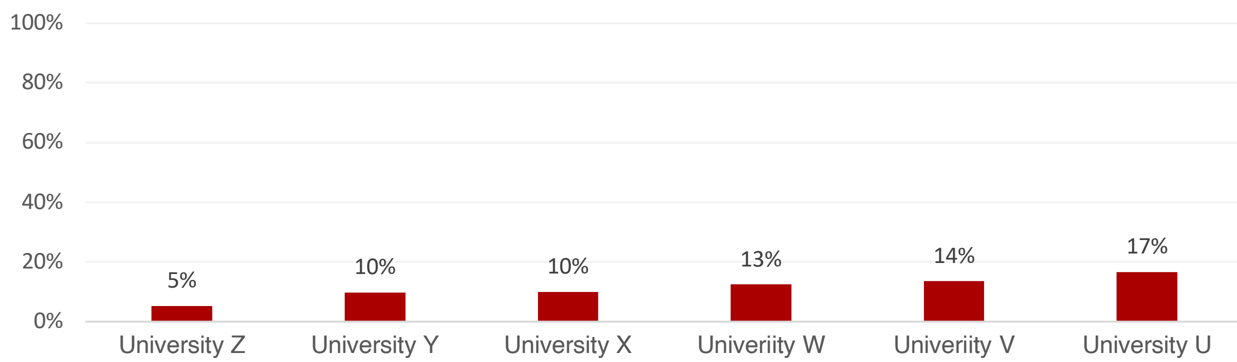
As noted, the mean scores of the two groups did not differ significantly, 43% for first years and 47% for fourth years. This is an overall gain or value add, from first year to fourth year of only 4 percentage points. There is evidence of improvement by fourth year level, with 56% of fourth year students (32% + 24% =56%) functioning at Level 3 (procedural fluency and some conceptual understanding) and Level 4 (advanced understanding) levels compared to 34% of first year students (22% + 12% = 34%). Of particular concern are students who function at Level 1 (below procedural fluency) and - approximately three out of every five at first year and one out of every five at fourth year level. We can infer that twenty percent of primary teachers entering the schooling system as primary schools teachers (who will teach mathematics), have only below basic fluency in mathematics

3. How many credits do universities' allocate to mathematics in B.Eds for primary school teachers?

Lecturing staff participating in the PrimTEd assessment collective are very concerned about this lack of progress from first to fourth year. Reasons for this are varied: insufficient course alignment to PrimTEd standards, poor entry level mathematics, insufficient training and knowledge amongst ITE lecturers for primary school (many of whom have a secondary school mathematics qualification), and insufficient time in the B.Ed programmes to work with students on their mathematics knowledge for teaching.

The lack of time in B.Ed programme allocated to mathematics is a serious constraint. In 2020, concerned about the poor attainment evident in the PrimTEd mathematics assessment, at first year and fourth year level, six universities – with a focus on historically disadvantaged universities with isiXhosa dominant student bodies - sought funding to commence a curriculum improvement project - Maths4Primary teachers. The lecturers participating in PrimTEd and wanting to now collaborate on improved course design collected information on the proportions of time (measured in credits) allocated to mathematics. Figure 6 shows the allocation of time to mathematics in Foundation Phase programmes. A Bachelor of Education (B.Ed) is a four year undergraduate qualification, with a minimum of 480 credits. The proportions of credits allocated for mathematics a minimal (with a maximum allocation of 72 credits, or 17% of the programme).

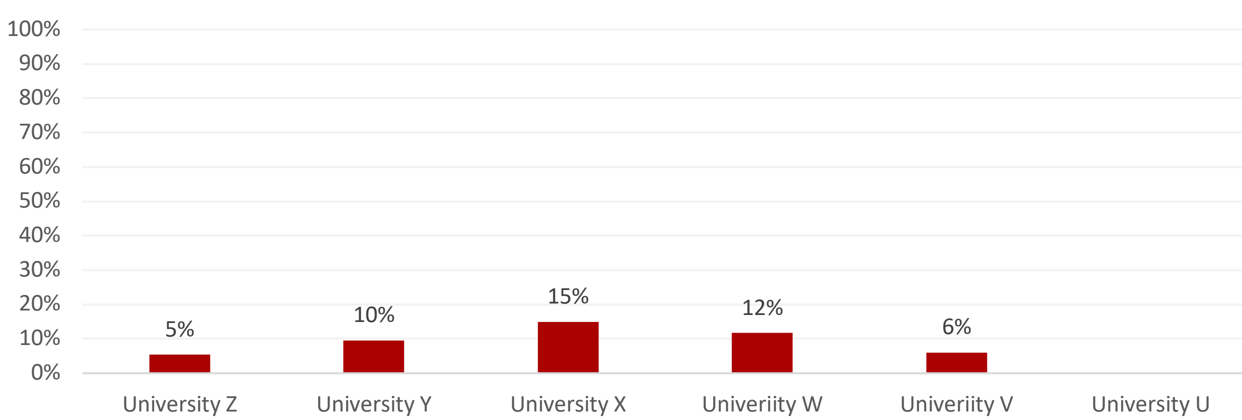
Figure 7: B.Ed (Foundation Phase) credit allocation to mathematics



Source: Adapted from Roberts & Porteus (2020) Maths4Primary teachers funding proposal, drawing on data collected from collaborating partners

There are similar findings for the B.Ed (intermediate Phase), with the maximum credit weighting to mathematics being 15%. It should be noted that some Intermediate Phase programmes offer mathematics as a specialization, and this allows for more mathematics credits as part of electives. At least two of the universities in 'Maths4Primary teachers' have made mathematics compulsory for all Intermediate Phase students. As every primary teacher tends to be a language, literacy and a mathematics teacher, we have reported the credit weighting for all teachers, and not just mathematics specialists.

Figure 8: B.Ed (Intermediate Phase) credit allocation to mathematics



Source: Adapted from Roberts & Porteus (2020) Maths4Primary teachers funding proposal, drawing on data collected from collaborating partners

Increasing the credit weighting of particular courses is a difficult political process, especially when the motivation for such comes from within a faculty, where deans, heads of school and fellow lecturers each value their own subject specialisation. The MRTEQ (2014) does not specify the expected credit allocation to mathematics or to languages and literacies. The revised MRTEQ (which was expected in 2021, but is still not published), is expected to include the PrimTEd knowledge and practice standards for mathematics and language and literacies, as an annexure.

The PrimTEd mathematics collective recommends that "at least 100 credits" (21% of the programme) is allocated to mathematics. It is expected that a further "at least 120 credits" (25% of the programme) is allocated to languages and literacies. This call is advocated for by Taylor and Mawoyo (2022). The urgency for the publication of the revised MRTEQ, and its guidelines on credit weightings for priority subjects, is evident as recent (September 2022) attempts to increase the credit weighting for mathematics and languages at one of the 'Maths4Primary teachers' universities, was accepted at the University School level, but later rejected by the Faculty, due use to lack of policy clarity (as the revised MRTEQ, was not yet published).

4. Summary

This paper presents several sets of evidence which make the following features of the South African initial education landscape for primary teachers very clear:

1. Universities start where secondary schools finish, so first year students entering primary education careers have weak mathematics literacy results, and very poor mathematics knowledge;
2. Candidates entering the education faculties (along with those in health/nursing) at universities have the weakest quantitative literacy skills (as measured by the NBTs) compared to Grade 12 candidates entering other faculties.
3. Universities have a herculean task of filling the mathematics knowledge gaps from a matriculant with a NSC Bachelors' degree pass and mathematics literacy.
4. Universities do not prioritise mathematics in their B.Ed programmes with credit weightings for mathematics ranging from 5% to 17% of the credits in the degree.
5. Given points 3 and 4, coupled with concerns about ITE lecturers capacity and specialized primary teaching skills, universities are not adding significant value in relation to mathematics knowledge for teaching in primary school. From 2017 to 2021 PrimTEd has collected assessment evidence that shows fourth year students only performing 4 or 5 percentage points higher than first year students, on the same PrimTEd mathematics test.
6. The PrimTEd process is being driven by the ITE lecturing staff themselves, who are concerned about the lack of progress, and have sought ways to collaborate and improve mathematics course offerings.
7. The ITE lecturer appetite for change and to gain specialized skills in the mathematics knowledge for teaching well at primary school level, is evident across at least 10 universities. These lecturers are engaged in PrimTEd, in Maths4Primary teachers to improve first year courses, and in Mental Maths Starters Project (MSAP), which is being used at third or fourth year levels.

As shown in Bohmer et al (2022) from the analysis of matric results of university entrants, it is evident that some of the mathematics (and mathematics literacy) deficiencies that student teachers bring from school persist to the end of the four-year B.Ed programmes. This does not only present a challenge to universities but also suggests that the vicious cycle of schooling and ITE reported in Taylor (2019) is yet to be broken.

Next steps

Given the above evidence it is clear that there are several possible next steps, which require urgent attention. Some pertain to DHET. Others pertain to DBE, which has to work together with DHET on initial teacher education and ongoing professional development. Others pertain to priority investments (from the state, and/or the state in partnership with funders).

At the policy level:

1. The DHET should publish the revised MRTEQ and include the PrimTEd knowledge and practice standards for mathematics and for language and literacy in this policy framework. It has been delayed since 2020, and is needed for 2023.
2. The DHET should include a firm recommendation for the credit weighting in B.Ed programmes (Foundation and Intermediate phase) for at least 100 credits in mathematics, and at least 120 credits for language and literacies.

At university level, with policy support:

3. Raise the entry requirements for incoming B.Ed entrants (prioritizing mathematics, and or higher scores in mathematics literacy). This however, mitigates against the calls for increasing quantity of teacher graduates in the next 5 to 10 years. The current enrolment is not sufficient for the countries' needs in the next decade.
4. Extend the B.Ed to a five year programme, with a first year focused on Mathematics, language and literacy. While this may seem costly, the long term benefits of better quality primary teachers, and student teachers who complete their B.Ed in the 5 year time frame may be a worthwhile trade off.

At the investment priority level:

5. Support the work of PrimTEd assessment, beyond 2023:

    a. Fund and support the PrimTEd assessment workstream, so that the evidence being gathered can take place annually, and with a wider involvement from the 25 universities. Without meaningful and regular data, the system cannot improve.
    b. The standards based reports shown above, have been used as examples to describe PrimTEd attainment across universities (Moloi, Kanjee and Roberts, 2019). The PrimTEd assessment workstream is in the process of updating the PrimTEd mathematics assessment, and developing an item bank mapped to the PrimTEd knowledge and practice standards (which are expected to be attached to the revised MRTEQ). Funding has only been secured to the end of 2023.
    c. To date, UNISA colleagues have participated in the PrimTEd assessment community of practice (2018-2021), but have not yet contributed assessment data from their students. As the largest provider of teachers in South Africa, UNISA should be supported to run the PrimTEd assessments annually.
    d. Over time the PrimTEd mathematics and language and literacy assessments at first and fourth year levels, should be compulsory tests for all universities (private and public) and requirements for their accreditation.

6. Fund and support the ITE lecturers who acknowledge the seriousness of this problem, are seeking capacity building and are willingly collaborating to improve their course mathematics offerings. Projects of relevance include,

    a. Maths4Primary teachers (lead by Roberts and Porteus), which includes a full online course offering and lecturer guides (at first year level).
    b. Mental Starters Assessment Project (lead by Graven and Venkat), which includes learner-based assessments and lesson starters for grade 3 number work to support teaching practice or Work Integrated Learning in ITE.
    c. A funded project, based on Maths4Primary teachers, but focused solely on UNISA failed to gain UNISA management approval, despite interest and collaborative effort from the relevant lecturers.

    These, and other interventions, at different years of the B.Ed programmes and with distinct domain foci should be incubated and supported.

7. The largest contributor to primary teachers in South Africa is UNISA. Ensure that the UNISA online courses are the best that can be offered, and draw on the innovations being designed and trailed at smaller scale in numerous other ITE sites (see 6 above).

References

Alex, J., & Roberts, N. (2019, January). The need for relevant initial teacher education for primary mathematics: Evidence from the Primary Teacher Education project in South Africa. In *Proceedings of the 27th Annual Conference of The Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE)* (pp. 15-17).

Bowie, L., Venkat, H., & Askew, M. (2019) Pre-service Primary Teachers' Mathematical Content Knowledge: An Exploratory Study, African Journal of Research in Mathematics, Science and Technology Education, 23:3, 286-297, DOI: 10.1080/18117295.2019.1682777

Council on Higher Education (2010). *Report on the National Review of Academic and Professional Programmes in Education. HE Monitor No 11.* Council on Higher Education. https://www.che.ac.za/publications/reports/higher-education-monitor-11-report-

Fonseca, K., Maseko, J. & Roberts, N. (2018) 'Students mathematical knowledge in a bachelor of Education (Foundation or intermediate phase) programme', in Govender, R. & Junqueira, K. (2018) Proceedings of the 24th Annual National Congress of the Association for Mathematics Education of South Africa, ISBN: 978-0-6399514-0-9, AMESA 2018 Long Paper, 25 – 29 June 2018 University of the Free State, Bloemfontein Campus, Free State, pp. 124-13

Moloi, Q. M., Kanjee, A., & Roberts, N. (2019). Using standard setting to promote meaningful use of mathematics assessment data within initial teacher education programmes. *Pythagoras*, *40*(1), 1-14.

Prince, R (2019) National Benchmark Test project: Latest NBT data, trends and implications, presentation to PrimTEd national working group, JET, Johannesburg

Primary Teacher Education Project (PrimTEd) (2020) *Mathematical Knowledge and Practice (MKP) Standards: Mathematics for Prospective FP and IP Teachers,* Department of Higher Education

Roberts, N. & Maseko, J. (2022) From measuring impact to informing course design: The second design trial of the Maths Intensive course *Journal of Education*, Issue 87, http://journals.ukzn.ac.za/index.php/joe doi: http://dx.doi.org/10.17159/2520-.

Roberts, N and Porteus, K (forth coming) Finding the zero in mathematics initial teacher education, Special Issue AJRMSTE on early grade mathematics

Roberts & Porteus (2020) *Maths4Primary teachers funding proposal*. Submitted to Zenex Foundation,

Stein, M. K., Grover, B. W., & Henningsen, M. A. (1996). Building student capacity for mathematical thinking in reasoning: An analysis of mathematical tasks used in reform classrooms. *American Educational Research Journal*, 33 (20), 455-488

Taylor, N. (2019). Inequalities in Teacher Knowledge in South Africa. In Spaull, N and Jansen, J. D. (ed.), *South African Schooling: The Enigma of Inequality: A Study of the Present Situation and Future Possibilities*, Springer International Publishing, 263—282.

Taylor, B. & Mawoyo, M. (forth coming) Professionalising Teacher Education: The case of Language and literacy, in E. Pretorius, and N. Spaull(eds) *Early grade reading in South Africa*, volume 2, Oxford University Press

Acknowledgements

PrimTEd is separate to the Teacher Demographic Dividend. This report has been developed for RESEP, to inform its work on the Teacher Demographic Dividend.

All PrimTEd data has been developed through the Teaching and Learning Development Capacity Improvement Programme (TLDCIP) which is being implemented through a partnership between the Department of Higher Education and Training and the European Union

The PrimTEd assessment workstream is lead by Prof Nicky Roberts, who is supported by a project management team comprising of Dr Monica Mawoyo, Dr Qetelo Moloi, Dr Thelma Mort and Megan Fisher. The individual academics who have participated in the mathematics assessment workstream, and contributed to the data in this report include: Mirriam Moleko, Mogege Mosimege, Msebenzi Rabaza (UFS), Ravindraw Bappoo, Glynnis Daries Jeffrey Thomas (SPU), Mzi Krexe, Jogymol Alex and Faith Hlungulu (WSU), Zonia Jooste, Sharon Mc Auliffe, Byron Abrahams (CPUT), Kaashief Hassan, Gary Powell, Zain Davis; Cally Kuhne (UCT), Erna Lampen (Stellenbosch), Lynn Bowie, Corin Mathews, Hamsa Venkat (WITS), Xoliswa Lydia Mbelani , Lise Westerway, Samu Chikiwa (Rhodes), Zingiswa Jojo (UNISA), Kathleeen Fonseca, Jerry Maseko, Emmanual Libusha (UJ), Rajen Govender (UWC), Beverley Williams, Nondwe Ngibe, Karen Hackman, Kim Porteus (UFH), Lynn Kok (Unizulu), Jeanette Ramolla, Anil Kanjee (TUT).